TSI CCS ETCS - Modifications and its resulting impact

Supporting slides for Workshop 6

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EUROPEAN
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FOR RAILWAYS

6. **TSI CCS ETCS modifications and its resulting impact**
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During this workshop a general summary of main foreseen TSI CCS modifications will be presented, considering that some of the technical changes are discussed in more detail in other workshops. We will be looking at:

- Specification's maintenance and error correction procedure.
- The transition and migration framework and the introduction of new functionalities.
- Single set of specifications.
- Partial fulfilment.

These modifications will be considered in the context of the expected European deployment in the coming years, with an increased number of ERTMS networks connected with vehicles operating across them.

Participants will be invited to exchange on the possible impact and opportunities that those changes will bring into existing and future systems.

- Topic 1 : CCS TSI – Content of ERTMS specifications (15 minutes)

- Topic 2:   CCS TSI – Content of CCS TSI Implementation framework (15 minutes)

- Topic 3: Questions from audience (60 minutes)

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ERTMS Specifications – Enhancements linked to 'Digital and Green rail'

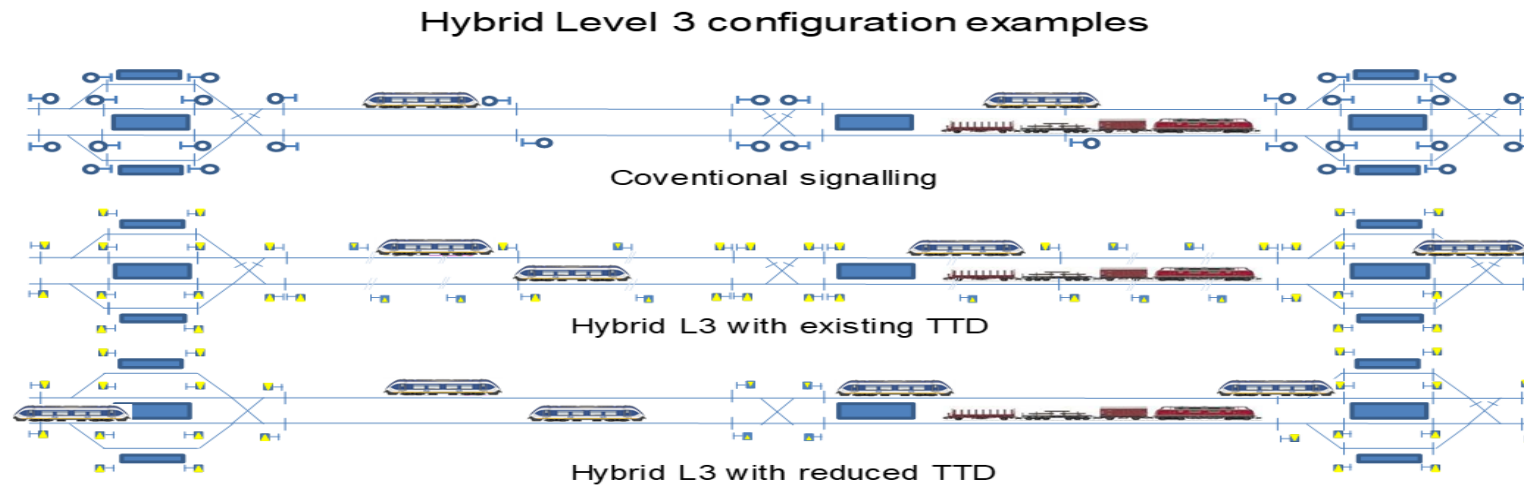| European Specifications in CCS TSI 2022	Link with strategic objectives
Automated Train Operation Grade 1 and 2 (ETCS over ATO)	ATO provides significant capacity benefits and reduced energy consumption (green rail). SPECIFIC WORKSHOP
ERTMS Readiness for 5G based communication (FRMCS)	GSM-R (2G) will become obsolete between 2035-2040 and shall be replaced by FRMCS (5G). Further digitalisation of rail as 5G opens many possibilities. SPECIFIC WORKSHOP
Digital ETCS reducing trackside assets	Hybrid Train Detection: Train integrity allows capacity increase and/or reduced trackside train detection systems. ETCS over DAC readiness: Supervised shunting allows safety increase and when using digital automatic coupling will allow to get rid of shunting signals
On-board modularity	On-board modularity enables further market opening which allows integration of different interoperability constituents/subsystems from different suppliers (open market). ERTMS specifications include additional specifications which provide on-board modularity focusing on a common Ethernet based system and providing harmonised interfaces between ATO, ETCS, FRMCS parts and RST-subsystem. SPECIFIC WORKSHOP
Additional enhancements to further optimise capacity, safety & security, cost reductions	The ERTMS specifications are further optimised - capacity: braking curve optimisation - safety & security: cyber-security - cost: reduction of number of balises to be installed in specific configurations

Game Changer: ATO GoA1/2

- ATO as new 3rd part in CCS TSI (ERTMS = ETCS + RMR + ATO)

- ATO TS/ATO OB as separate ICs (fully decoupled from ETCS and radio)

- TSI CCS focuses on the ATO TS/OB interoperable part.

Note: the ATO OB is a black box which defines its own algorithms (e.g. DB Cargo driving rules can gradually be optimised and integrated in the ATO OB, but these optimisations do not affect the interoperable part).

Game changer 'ETCS L3': improve capacity and reduce costs

Background: Hybrid concept: https://ertms.be/sites/default/files/2022-02/1 (Source: EUG)

Hybrid Level 3 configuration examples

Coventional signalling

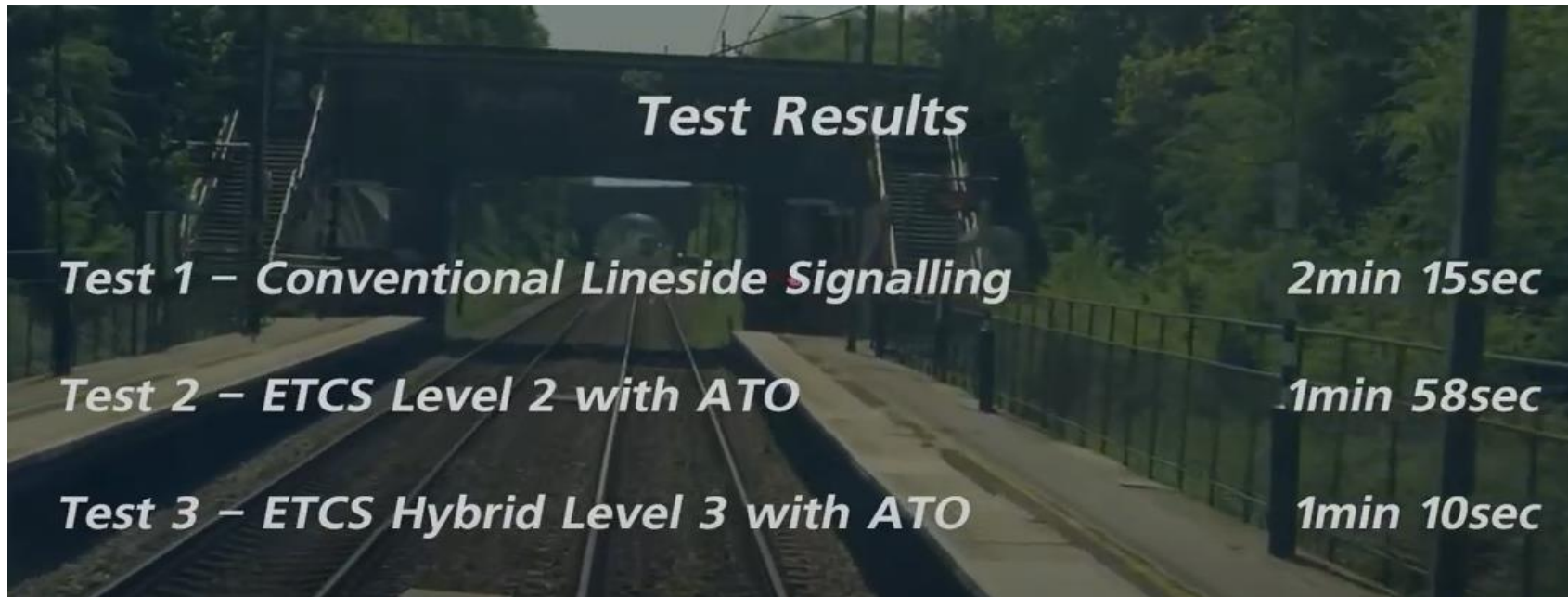Hybrid L3 with existing TTD

Hybrid L3 with reduced TTD

=> Underlying ETCS CRs:
-   CR 'Missing safety requirements for ETCS L3'
-   CR 'Merge ETCS Level 2 and Level 3 towards ETCS Level 'R'

Game changers: improve capacity and reduce costs

Background: ENIF HL3 ATO - YouTube

ETCS and supervised manoeuvres ('ETCS over DAC readiness'; DAC=Digital Automatic Couplers).

- Objectives: To achieve interoperability for supervised manoeuvres (note: other change requests related to (national) shunting movements are rejected)

a.   Get rid of shunting signals as well as other signals and reduce, where possible, the number of signal boards, to achieve cost reduction on trackside;

b.   Increase safety for shunting movements by applying the concept of 'Supervised manoeuvres'

c.   Increase performance by providing complete train positioning information to allow infrastructure to be released in rear of train

- Underlying ETCS CRs: 'Cab anywhere supervision'; 'Always connected, always located'

- Some examples of additional enhancements being processed as part of CCS TSI 2022:

Id number	Headline
1240	Attack from unlinked balise
1344	Improvement of conversion model
1346	Radio Remote control shunting under ETCS
1357	Eurobalise for Three-Rail tracks
1370	Relocation without linking
1374	Non-Leading
1375	Raise driver awareness on approaching an EOA

Note: number of enhancements: +/- 20

- Background:

a) Classification of change requests in ERTMS CCM Procedure (see ERA website: ERTMS Change Control Management procedure (16).pdf)

> 2.3.3.3.2   A CR shall be classified as an Error when it relates to any inconsistency, gap found in a document or in the documentation set.

> 2.3.3.3.3   Conversely a CR which is not classified as an Error shall be considered as an Enhancement, normally leading to new or modified requirement(s) in the FRS.

b) Maintenance of specifications (error corrections): Note: number of errors being processed after B3R2 publication in the period 2015-2022 (including the errors already published in the Technical Opinions): +/- 80

Which enhancements justify the introduction of a new ETCS system version 2.2 and 3.0?

ETCS up to system version 1.1
(introduced in Baseline 2)

ETCS up to system version 2.0
(introduced in Baseline 3MR1)

ETCS up to system version 2.1
(introduced in Baseline 3R2)

New:
ETCS up to system version 2.2 (ready for ATO)

(introduced as part of Baseline 4)

New:
ETCS up to system version 3.0 (ready for FRMCS/ supervised manoeuvres)

(introduced as part of Baseline 4)

- new compatible functions (backwards and forwards) introduced as part of ETCS system version 2.2;

- new incompatible functions (backwards compatible, but not forwards compatible) introduced as part of ETCS system version 3.0;

Broad return of experience from projects allows to include all errors detected from ongoing projects between 2015 and 2021 (focusing on specification gaps and ambiguities which could prevent the normal service). This broad return of experience allows that this return of experience can be used across the different trackside and on-board ERTMS projects.

ETCS BASELINE 4 (SINGLE SET OF SPECIFICATIONS)

SS-104 indicates which on-board requirements/documents only apply for 3.0	SS-104 indicates which on-board requirements/documents only apply for 3.0	SS-104 indicates which on-board requirements/documents only apply for 3.0	
SS-104 indicates which on-board requirements/documents only apply for 2.2	SS-104 indicates which on-board requirements/documents only apply for 2.2		
SS-104 indicates which on-board requirements/documents only apply for 2.1			
Train with envelope of ETCS system versions 1.0 to 2.0 inclusive (including error corrections for system versions 1.0 up to 2.0)	Train with envelope of ETCS system versions 1.0 to 2.1 inclusive (including error corrections for system versions 1.0 up to 2.1)	Train with envelope of ETCS system versions 1.0 to 2.2 inclusive	Train with envelope of ETCS system versions 1.0 to 3.0 inclusive

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Key Message 2.1: Balancing stability and innovation

Balancing IM/RU economic interests: How to handle innovations for the railway system which have a different business case for the Infrastructure Managers and Railway Undertakings. Example: Reduce trackside assets ('digital rail') might require new mandatory on-board functions to be implemented for existing and new vehicles (e.g. Digital Automatic Coupling, Train Integrity, FRMCS and associated ETCS related changes).

CCS TSI text:

- Update of National Implementation Plan by 15th December 2023: Member State's obligation to balance different expressed needs between impacted stakeholders (IM and RUs) to decide on ATO implementation, new FRMCS radio system or new ETCS system version;

- If Member State decides for implementation of new functions a minimum timeframe shall be provided:

  - minimum guaranteed compatibility window of 7 years after entry into force of the TSI; AND

  - minimum notification period of 5 years by IMs;

- EU Policy objective: Providing fully compliant ERTMS products (without deviations/partial fulfilment) allowing vehicles to operate across the EU (without additional restrictions/modifications if the area of use of a vehicle is extended).

- Balancing IM/RU economic interests: IMs would like that error corrections are implemented in the vehicles in order that temporary mitigation measures can be removed. IMs/RUs depend on their suppliers for integration of error corrections in their products.

$\Rightarrow$ CCS TSI text: Enforces the maintainability and responsibility of the trackside and on-board suppliers for implementation of errors in products and corrections to be done in products based on error corrections in the specifications **within a maximum framework of 2 years**.

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	Error Corrections On-Board/Trackside	Enhancements On-Board/Trackside
Before CCS TSI 2022	Depending on the contractual clauses between IM/RU and manufacturer. Market failure: no reasonable maintenance contracts offered by some manufacturers (probably those manufacturers who have not an efficient process to implement error corrections or have no standardised ETCS OBU)	Implementation of new functions or enhancements of existing functions are the responsibility of the request of the IMs and RUs. Most on-board enhancements are requested by the IM (improvement business case of the IM), however the RU upgrade costs are paid by the RU.
After CCS TSI 2022	Manufacturers are legally responsible for implementation of error corrections (not depending on contracts) Impact: this could increase the initial costs, but will penalise those manufacturers with non efficient processes to implement error corrections **Fast transition regime for error corrections**	How to balance Infrastructure Managers and Railway Undertakings individual business interests? TSIs do not allow to define compensation schemes between IM/RUs. CCS TSI: Minimum guaranteed compatibility window of 7 years for the RUs. **Generic transition regime for enhancements**

Background: The TSI aims to provide a future proof framework to enforce a more coordinated and balanced approach between Member States, IMs and RUs for the introduction of new compatible enhancements and incompatible enhancements.

Question 1 : How different is this approach from past experiences where the TSI did not implement transition framework or enforce coordination?

E.g. If RUs request to have ATO GoA1/2 implemented on certain trackside lines, is there any mechanism or national process available?

E.g. If IMs request to have GPRS implemented on vehicles, is there any mechanism or national process available?

E.g. If IMs request to have ETCS Baseline 2 upgrade to Baseline 3 for existing vehicles, is there any mechanism or national process available?

Background: The TSI aims to provide a future proof framework to enforce a more coordinated and balanced approach between suppliers, IMs and RUs for the maintenance of the ERTMS system.

Question 2: How different is the proposed approach from past experiences where the TSI did not implement a transition framework or enforce coordination for the implementation of errors in products or implementation of specification errors which could prevent normal service?

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